

PATENT SPECIFICATION (11)

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(54) PHOTOGRAPHIC LENS

(71) I, GEOFFREY ELLIS HARWOOD, a British subject, formerly of 47 Dudley Gardens, Harrow, Middlesex, now of 59 Wellington Road, Hatch End, Middlesex, HA5 4NF, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to lenses for photographic cameras particularly for underwater photography.

Underwater photography in poor visibility demands a wide angle of view, and angles of 90° are becoming commonplace. Wide-angle lenses designed specifically for underwater use have been in use for many years, and specially designed correction ports on underwater camera housings have been produced so that wide angle air lenses can be used underwater.

The present invention comprises a lens attachment by means of which a standard underwater camera lens may have its angular field increased for underwater use.

According to the present invention, a wide-angle lens attachment for an underwater camera lens comprises, in order from front to back, a dome element, a planoconcave negative lens element, a positive lens element, and a plane port, the lens attachment elements being computed to increase the field of view of the underwater camera lens.

The positive element may be a plano-convex element or, preferably, a double convex element.

The invention also includes an underwater camera having such a lens attachment mounted thereon to increase the field of view of the camera lens.

The lens attachment may be computed to correct, at the expense of linear distortion, wide-angle shape distortion of objects viewed near the edge of the field. This is preferable for much photography of underwater scenes where straight lines are the exception.

Alternatively, the lens attachment may be computed to provide correction to a rectilinear criterion. Such an attachment may

be of use for photogrammetric work and for photomosaics.

One embodiment of wide-angle lens attachment in accordance with the invention will now be described by way of example with reference to the accompanying diagrammatic drawing, which shows an axial cross-section of the attachment.

Referring to the drawing, the lens attachment 1 is arranged to be attached in a releasable manner, with a water-filled space between the rear of the lens attachment and the camera port 2. The camera lens is indicated at 3.

The wide-angle lens attachment 1 comprises several air-spaced elements. The front element is a part-spherical dome 4, the second element is a plano-concave negative lens element 5, the third element is a double convex positive lens element 6, and the fourth element is a plane rear port 7. The elements are supported by a water-tight housing 8.

The embodiment described is intended for use underwater attached to a Nikonos or Calypso-Nikkor II underwater camera having a 35mm W-Nikkor camera lens. Nikkor is a Registered Trade Mark. Attachment 9 securing the lens attachment to the camera housing 10 is shown diagrammatically as a push-on sleeve but other suitable means, including co-operating screw threaded flanges or hold-down bolts or hinges, will be known to those skilled in the art.

For use with this camera lens the elements of the lens attachment are made from acrylic plastics material. The radii R_1 and R_2 , respectively of the inner surface of the dome element 4 and of the curved surface of the negative element are 45mm and 35mm respectively. The radii of curvature of the positive lens are 185mm for the surface facing the negative lens and 62.5mm for the surface facing the plane port.

Several advantages result from use of this lens attachment:—

Firstly, the lens attachment can be removed from the camera in the water, or swung to one side if suitably mounted. The camera is then rapidly returned to its normal mode of operation.

Secondly, the focusing range of the camera can readily be extended to closer distances merely by securing the lens attachment to the camera.

- 5 Thirdly, a camera with the lens attachment can operate at the aperture of the camera lens. A camera lens having a similar angle of view to that obtained by using the lens attachment would probably operate at
10 a smaller aperture, and in any event would probably be more expensive to construct than the embodiment described.

It will be appreciated that these three advantages apply both to the embodiment described and to a lens attachment corrected to a rectilinear criterion. The design of a lens incorporating either of these corrections is within the competence of a skilled lens designer.

- 20 The fourth advantage obtained with the embodiment described is the more pleasing reproduction of many underwater scenes by the avoidance of shape distortion (elongation) of objects close to the edge of the field
25 of view in oblique views.

underwater camera lens comprising, in order from front to back, a dome element, a plano-convex negative lens element, a positive lens element, and a plane port, the lens attachment elements being computed to increase the field of view of the underwater camera lens.

2. A lens attachment as claimed in Claim 1, wherein the positive element is a plano-convex element.

3. A lens attachment as claimed in Claim 1, wherein the positive element is a double convex element.

4. A lens attachment as claimed in Claims 1 and 3, wherein the radii of curvature of the curved surfaces of the elements are substantially as hereinbefore described with reference to the accompanying drawing.

5. An underwater camera having mounted thereon a wide-angle lens attachment as claimed in any preceding claim.

6. A wide-angle attachment substantially as hereinbefore described with reference to the accompanying drawing.

WHAT I CLAIM IS:—

1. A wide-angle lens attachment for an

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COMPLETE SPECIFICATION

1 SHEET

*This drawing is a reproduction of
the Original on a reduced scale*

